2001 PROVINCIAL LEARNING ASSESSMENT IN MATHEMATICS

(Summary Report)

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Preface

The following document is a summary report of the 2001 Provincial Mathematics Assessment. It provides a brief snapshot of students' opportunity-to-learn in mathematics, students' performance outcomes in mathematics, and teacher and student attitudes and practices related to mathematics teaching and learning.

More information and data from the provincial mathematics assessment is available, but not presented in this summary report. Specifically, documents are available online that feature:

- Student tasks and item analysis showing student performance for each question;
- Scoring guides for performance tasks;
- Student and teacher questionnaires and item results; and,
- Rubrics describing characteristics at different levels of opportunity-to-learn and different levels of performance.

This information may be useful as educators, administrators, consultants, students and organizations plan for and work toward improving student opportunity and outcome results in mathematics. Please visit the Saskatchewan Learning website at http://www.sasked.gov.sk.ca/k/pecs/ae/plap.html for more information.

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Table of Contents

Executive Summary *i*

Introduction 1

Scope and Nature of the Assessment 1

- Test Components 1
- Student Participation 1
- Format of the Assessment 2
- Deciding Whether Student Opportunities or Outcomes are Sufficient 2

Opportunities to Learn Mathematics (OTL) 3

- What is Opportunity-to-Learn? 3
- Classroom-Related Opportunities-to-Learn 4
  - *Classroom Instruction and Learning* 4
  - *Availability and Use of Resources* 5
  - *Problem Solving in the Mathematics Classroom* 6
- Readiness-Related Opportunities-to-Learn 7
  - *Students' Preparation for and Reflection on Their Learning* 7
  - *Students' Persistence in Solving Difficult Math Problems* 8
- Support-Related Opportunities-to-Learn 9
  - *General Support for Learning* 9
  - *Support for Learning Math* 10

Student Achievement 12

- Introduction 12
- Determining Student Achievement 12
- Performance Station Test Results 13
  - *Results of a Common Task Among Grades 5, 8 and 11* 15
  - *Results of Mathematics Communication Grades 5, 8 and 11* 16
  - *Comparison of Results between 1997 and 2001* 19
- Grade 5 Paper-and-Pencil Test Results 20
  - *Computation Skills* 20
  - *Mathematical Content Skills* 22
  - *Problem-Solving Skills* 23

Student Achievement, Attitudes and Practices 24

- Gender Differences in Achievement 24
- Student's Attitudes in Mathematics 25
- Calculator Use and Computation Skills 27
- Readiness-Related Opportunity-to-Learn and Achievement 28
- Other Student Related Findings 29
- General Support for Learning and Achievement 30
- Teacher Pre-Service and Achievement 31
- Teacher Attitudes and Practices 32
  - *Classroom Instructional Time* 33

Conclusions and Next Steps 35

Executive Summary

In May 2001, over 2000 Grade 5, 8 and 11 Saskatchewan students from 103 randomly selected schools participated in the 2001 Provincial Mathematics Learning Assessment. This was the third provincial mathematics assessment, the first step of which occurred in 1995.

A standard-setting panel representing education partners set provincial standards and expectations in mathematics for students' opportunities to learn and performance outcome results.

Opportunities to Learn Mathematics

The standard-setting panel considered three classroom-related, two readiness-related, and two support-related opportunity-to-learn elements. They determined that:

- Fewer than expected Saskatchewan classrooms meet panelists' expectations related to instruction and learning, the availability and use of mathematics resources, and the quantity and type of problem-solving approaches undertaken in mathematics classrooms.
- The number of Grade 5 students met, and fewer than expected Grade 8 and 11 students are not meet panelists' expectations related to their preparation and commitment to learn and in their persistence in solving difficult math problems.
- The number of Saskatchewan students met expectations with respect to home support for learning in general. With respect to support at home for learning mathematics, the number of Grade 5 students met and the number of Grade 8 students approached expectations. Fewer than expected Grade 11 students met expectation surrounding this home support.

Outcomes of Student Learning in Mathematics

Over 1500 of the sampled students completed performance-based tests. These tests required a "hands-on" approach when considering possible solutions to practical problems. Students could attain one of five levels of achievement. *Level 1* is basic and *Level 5* is exemplary. Achievement at *Level* 3 or better represents adequate mathematics proficiency.

- The percentage of Grade 5, 8 and 11 students attaining adequate mathematics proficiency met provincial expectations.
- Students' skills at communicating their mathematics understanding were assessed. Panelists determined that the percentages of Grade 5, 8 and 11 students demonstrating adequate communication of their mathematics understanding were below provincial expectations.

The 2001 provincial mathematics assessment had many student performance tasks duplicated from the 1997 provincial mathematics assessment. When comparisons between the two assessment results were investigated we found:

- Overall there were very few statistically significant differences in performance outcome between 1997 and 2001. When there were differences, the results from the 2001 assessment were actually better than the 1997 assessment.

A different sample of over 500 Grade 5 students wrote provincially developed paper-and-pencil tests. These tests assessed students' computation skills, content mastery skills, and problem-solving skills.

- Grade 5 students met provincial expectations for adequate mathematics proficiency on the problem-solving test.
- Overall, Grade 5 students' computation skills in 2001 match 1997 results. Results of the four subtraction and division questions are lower in 2001 than in 1997.
- Results of the multiple-choice test show Grade 5 students lack mastery and application of many concepts, procedures and relationships. This is particularly true for fractions and geometry. These results are consistent with those found in 1997.

During the same time the provincial assessment was being conducted a second set of Grade 8 and 11 students wrote national paper-and-pencil tests designed and administered through the School Achievement Indicators Program *(SAIP)*. These tests assess the mathematics content knowledge and problem-solving skills of Canada's 13- and 16- year-olds. These results for the achievement of Grade 8 and 11 students can be found in the *School Achievement Indicators Program Mathematics Report*. More information can be found at http://www.cmec.ca/saip/math2001/public/indexe.stm.

Other findings about students' attitudes and achievement include:

- Most students believe their classroom mathematics is useful.
- Most Grade 5 students like mathematics and are confident in their abilities. Fewer Grade 8 and Grade 11 students report such attitudes.
- On average, students who like mathematics and those who are confident when doing mathematics achieved higher scores than their counterparts.
- Grade 5 and 8 females achieved higher scores than males for written communication in mathematics. Otherwise, there were no overall performance differences between males and females.

Introduction

What are the opportunities for Saskatchewan students to learn mathematics, and what are the outcomes of that learning? The 2001 Provincial Learning Assessment in Mathematics showed results that were similar to findings summarized by two earlier provincial mathematics assessments, in 1995 and 1997.

In May 2001, Grades 5, 8 and 11 Saskatchewan students completed questionnaires and tests demonstrating assessed attitudes, practices, mathematics knowledge and problem-solving skills. This report summarizes the major findings.

Scope and Nature of the Assessment

Test Components

Participating Grade 5 students completed one of:

- A paper-and-pencil component providing data on mathematics knowledge and problem-solving skills; or
- A performance-based or practical applications component testing application of mathematics to solve hands-on or experimental problems.

Grade 8 and 11 students participating in the provincial assessment were offered only the performance-based *(practical applications)* component. Other students in these grades were chosen to write the national tests *(please see adjacent text boxes).*

Students had opportunity to show their general numeracy skills, creative and critical thinking, and proficiency in communicating mathematics understanding. Tasks required students to integrate and apply knowledge and skills from several areas of Core mathematics curriculum.

Student Participation

Classrooms from 103 schools in urban, rural, and northern Saskatchewan participated. Students in a classroom completed either the paper-and-pencil component or the performance-based component, not both.

Students enrolled in regular mathematics programs participated. Students in modified programs, where foundational objectives of the course were altered, did not participate.

In 2001, Saskatchewan participated with the other provinces and territories in the School Achievement Indicators Program (SAIP) Mathematics Assessment. The SAIP assessment, developed by the Council of Ministers of Education, Canada (CMEC) was administered to 13- and 16-year-olds. It provided assessment data on math content knowledge and problem-solving for Grade 8 and 11 Achievement results for 13- and 16-year-olds are reported in the *SAIP Mathematics Report*. Please visit the website for more information http://www.cmec.ca/saip/math2001/public/index.stm

This Provincial Learning Assessment Report summarizes student achievement for:

- the performance-based component for each of Grades 5, 8, and 11; and,
- the paper-and-pencil component for Grade 5.

Performance-based tests were completed by:

- 527 Grade 5 students;
- 440 Grade 8 students; and,
- 520 Grade 11 students.

Paper-and-pencil tests were completed by:

- 503 Grade 5 students; and,
- 1890 students at age 13 and 1698 students at age 16 (wrote the national SAIP tests).

Format of the Assessment

Grade 5 classrooms chosen to complete the paper-and-pencil component scheduled 2½ to 3 hours total time for the assessment. The first day, students completed the computations part (8 questions) and the multiple-choice part (40 questions). The second day, students completed the six-problem, open-response test.

Grade 5 students chosen to complete the performance-based component did so during one 2½-hour time period. Students worked at a set of tasks/problems at each of six performance stations.

The teacher or a school-designated coordinator administered the tests in the classroom between April 2nd and May 4th in the classroom by the teacher or a school-designated coordinator. Students completed a questionnaire about their attitudes toward and practices in mathematics. Teachers answered a questionnaire on their beliefs, practices, and perceptions related to mathematics.

Deciding Whether Student Opportunities or Outcomes are Sufficient

We invited educational partners to send representatives to set standards related to:

- students' opportunities to learn mathematics; and,
- student achievement outcomes in mathematics.

These representatives formed the standard-setting panel. In this report, they are identified as standard-setters or panelists. This group of parents, students, teachers, directors, post-secondary educators, business people, and trustees considered the full context of the assessment. They:

- reviewed factors affecting students' opportunities to learn mathematics;
- attempted some of the test items and tasks;
- viewed examples of student work at various achievement levels; and,
- discussed students' opportunities and how well students would do.

The standards they set are the expectations for opportunities to learn and outcomes. Standards and expectations set by the panelists provide for the reader a comparator to judge adequacy of the assessment results. The report presents student questionnaire and achievement information alongside the panelists' expectations.

Opportunities to Learn Mathematics (OTL)

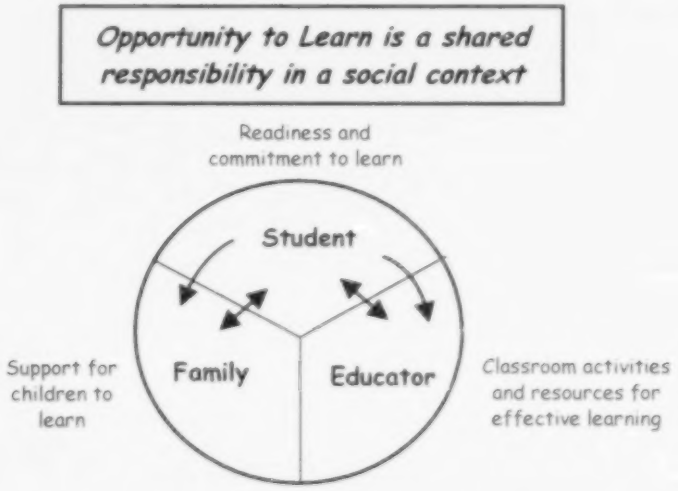
What is Opportunity to Learn?

Student achievement outcomes are influenced not only by differences in student ability, but also by differences in student experiences. The classroom and school, the home and community, and the students themselves all influence the type, quality and extent of learning. Providing students with the opportunity to increase numeracy and problem-solving skills is a shared responsibility.

Opportunity-to-learn refers to the conditions that facilitate learning.

Outcomes describe the product or results of learning such as the skill levels demonstrated by students.

Figure 1: Model of Opportunity to Learn


Opportunity to Learn is a shared responsibility in a social context
Readiness and commitment to learn
Student
Family
Educator
Support for children to learn
Classroom activities and resources for effective learning

Standard-setting panels reviewed 5-level rubrics describing seven different elements of opportunity to learn. *Level 1* is considered basic and *Level 5* advanced. For each of the seven elements a standard was set by panelists identifying which level would represent sufficient or adequate opportunity to learn. Because panelists' responses were averaged, the standard was often a decimal number. A standard of 3.6 for example, means that the average value of all panelists' responses fell between levels 3 and 4, and that the standard of sufficiency would be described by some characteristics at *Level 3* and some at *Level 4*.

After setting the standard, panelists then considered the range of student needs and characteristics, the different learning styles and the different learning environments throughout the province. Based on this consideration they set a percentage expectation as to what percentage of students at each grade level should have sufficient opportunity-to-learn consistent with the standard they had set. These percentage expectations are presented in the second last row of the tables of this section.

This next section of the report displays the Opportunity-to-Learn results. These tables display for each grade:

- the percentage of students who are described at each of the five levels;
- the average standard level of opportunity determined by panelists;
- the percentage of students that are expected to meet this standard; and,
- the number of students or classrooms that meet the determined standard.

The OTL results and the rubrics that are used can serve as beginning discussion points or points of further investigation as school personnel plan and support student learning. They do not tell the whole story and are not definitive. Care should be taken in reviewing and interpreting the results.

Classroom-Related Opportunities to Learn

The standard-setting panel considered three classroom-related OTL elements. For all three classroom-related elements, the panelists concluded that fewer than expected numbers of students met the standard of sufficient opportunity.

Classroom Instruction and Learning

What takes place in math classrooms can have a great impact on the extent to which students learn and understand mathematics. This OTL element attempts to capture some of the many processes and actions occurring in mathematics classrooms. These include such characteristics as the approaches to teaching and learning mathematics, the use of resources and adaptations undertaken for students, assessment practices, and teacher and student attitudes toward teaching and learning mathematics. It should be noted that the other two classroom-related OTL elements are subsets of this element.

Figure 2: Classroom Instruction and Learning, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Teacher Responses		
	Grade 5	Grade 8	Grade 11
Level 1: Emphasis is placed on learning and repeating math procedures through drill exercises. Classroom learning occurs primarily through lecture or independent study.	*2.1%*	*0.0%*	*0.0%*
Level 2: Learning of math procedures is accompanied by a notion or surface understanding of how and why procedures work. Learning is usually through direct instruction. Other instructional methods are used occasionally.	*30.5%*	*6.9%*	*31.1%*
Level 3: Math is learned through the introduction and practice of procedures. The teacher demonstrates and explains why it works through the use of manipulatives, calculators, computers, group-work, and journals.	*45.3%*	*44.8%*	*51.1%*
Level 4: Occasionally students learn and explore new math concepts through problem-solving activities. A wide variety of instructional approaches and resources are utilized in the mathematics program.	*16.8%*	*37.9%*	*17.8%*
Level 5: Students learn mathematics in a problem-solving context that allows them to explore and be challenged in their thinking of mathematical concepts.	*5.3%*	*10.3%*	*0.0%*
Sufficient Standard Level	***3.3***	***3.3***	***3.1***
% expectation of standard-setters	***80%***	***90%***	***90%***
% of classrooms meeting the standard	***56%***	***82%***	***64%***

Note 1: Number of Participating Teachers: Grade 5: 95, Grade 8: 29, and Grade 11: 46.
Note 2: Descriptions outlined in chart do not include all characteristics within the OTL rubric. For example, some problem-solving activities are described in lower levels. *(Please refer to OTL rubric found on this website.)*

Figure 2 shows that:

- About 70% of Saskatchewan mathematics classrooms have classroom instruction and learning at *Level 3* or above as described by the OTL rubric.
- Fewer than expected numbers of Saskatchewan classrooms meet panelists' standard for sufficient instruction and learning of mathematics.

Availability and or Use of Resources

Resource materials for instructional preparation and classroom learning can provide broader opportunity for improved student learning in mathematics. The availability and skillful use of calculators, manipulatives, print materials, and Internet sources along with appropriate instructional time and prepared instructors can enhance students' opportunity to learn mathematics.

Figure 3: Availability and Use of Resources, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Teacher Responses		
	Grade 5	Grade 8	Grade 11
Level 1: There is a shortage of resource materials for teachers and students. Learning is dictated by one textbook.	*2.1%*	*0.0%*	*0.0%*
Level 2: Some other resources (other than the textbook) are used to break up the classroom routine, but they do not relate to the concepts being learned.	*38.9%*	*13.8%*	*15.2%*
Level 3: A variety of resources are used at least occasionally to reinforce an earlier learned concept.	*28.4%*	*37.9%*	*67.4%*
Level 4: Resources are an important supplement to the teaching and learning of mathematics.	*26.3%*	*44.8%*	*15.2%*
Level 5: Resources are an integral part of the teaching and learning of mathematics.	*4.2%*	*3.4%*	*2.2%*
Sufficient Standard Level	*3.2*	*3.3*	*3.3*
% expectation of standard-setters	*88%*	*90%*	*90%*
% of classrooms meeting the standard	*54%*	*75%*	*65%*

Note 1 Number of Participating Teachers: Grade 5: 95, Grade 8: 29, and Grade 11: 46
Note 2 Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Figure 3 indicates that:

- About three in five Grade 5 classrooms and four in five Grade 8 and 11 classrooms have and use mathematical resources at *Level 3* or above as described by the OTL rubric.
- Three-quarters of Grade 8 and more than half of Grade 5 and 11 classrooms in Saskatchewan have and use mathematical resources at a sufficient level as described by the OTL rubrics. Approximately 90% of the classrooms are expected to reach this level.

Problem Solving in the Mathematics Classroom

Learning mathematics in a problem-solving context generates excitement, challenge and meaningfulness in the mathematics classroom. As an area of increased emphasis in the mathematics curriculum, this OTL element brings focus to an important aspect of mathematics teaching and learning. Results show that Saskatchewan mathematics teachers need to address this increased area of emphasis as outlined in the curriculum *(See Figure 4)*.

Figure 4: Problem Solving in the Mathematics Classroom, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Teacher Responses		
	Grade 5	Grade 8	Grade 11
Level 1: Little or no problem solving occurs, often because there is "no time" to undertake such activity.	2.2%	3.4%	0.0%
Level 2: Problem solving is an add-on or peripheral activity in which the problems presented are "textbook" like and have one "acceptable" answer.	47.3%	69.0%	66.7%
Level 3: Problem-solving is an important supplement and the development of a variety of strategies to solve problems is encouraged within the classroom.	29.0%	17.2%	20.0%
Level 4: Problem-solving is an integral part of the math program and wide ranges of problems are used to develop a range of problem-solving strategies.	11.8%	3.4%	8.9%
Level 5: Problem-solving is the central focus of the math program. A wide variety of problems are used not only to develop a range of problem-solving activities, but also to explore new math concepts and develop understanding.	9.7%	6.9%	4.4%
Sufficient Standard Level	*3.6*	*3.4*	*3.6*
% expectation of standard-setters	*78%*	*70%*	*60%*
% of classrooms meeting the standard	*34%*	*21%*	*22%*

Note 1: Number of Participating Teachers: Grade 5: 95, Grade 8: 29, and Grade 11: 46
Note 2: Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Readiness-Related Opportunities to Learn

Students' opportunities to learn are shaped by attitudes, values and commitment to learn. The standard-setting panel considered two student-related OTL elements. It was found that Grade 5 students approached provincial expectations and fewer than expected Grade 8 and 11 students showed sufficient readiness to learn.

Students' Preparation for and Reflection on Their Learning

Students who prepare for class, pay attention in class and reflect upon what they have learned position themselves to do well in school.

Figure 5: Student Preparation and Commitment to Learn, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Student Responses		
	Grade 5	Grade 8	Grade 11
Level 1: Students are not prepared for class and pay little attention to the class activities. They do very little homework and believe math is not important.	2.2%	2.8%	3.7%
Level 2: Students are sometimes prepared for class and try to pay attention, but they are often distracted or become bored and stop working on the class activities. They commit little time or effort for homework.	27.5%	32.9%	35.6%
Level 3: Students are usually prepared for class and usually work on class activities. They tend not to think about what they did in class and what they could do to improve their understanding.	41.1%	45.2%	37.3%
Level 4: Students come prepared for class and work on the class activities. They often think about what they have done in class and how they might improve their understanding.	21.7%	16.1%	19.7%
Level 5: Students regularly set and review goals for what they want to learn. They work on the class activities and regularly check to see how well they are doing or how they might improve to achieve their goals.	7.5%	3.0%	3.7%
Sufficient Standard Level	**3.0**	**3.0**	**3.2**
% expectation of standard-setters	**78%**	**85%**	**80%**
% of students meeting the standard	**70%**	**64%**	**54%**

Note 1: Number of Participating Students: Grade 5: 1049; Grade 8: 437; and Grade 11: 520.
Note 2: Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Figure 5 shows that:

- About two-thirds of Grade 5 and 8 and more than one-half of Grade 11 students in Saskatchewan are usually prepared for class and try to work on their classroom activities.
- Grade 5 results generally match the expected minimum level of self-preparation and commitment to learn; however Grade 8 and 11 results fall short of provincial expectations.

Students' Persistence in Solving Difficult Math Problems

Persistence refers to the students' tendency to stick with a problem until it is solved and understood by them. Students demonstrate a high degree of persistence by engaging in self-directed problem solving and staying with a problem as long as they can without giving up, and returning to a problem as they gain new insights.

Figure 6: Student Persistence to Solving Difficult Problems, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Student Responses		
	Grade 5	Grade 8	Grade 11
Level 1: The student will quit and give up doing a problem as soon as he she encounters a little difficulty.	*6.1%*	*6.1%*	*4.6%*
Level 2: Sometimes the student works to solve a difficult problem, but more often than not they skip the difficult problems, but continue to work on other problems.	*19.9%*	*18.2%*	*19.3%*
Level 3: The student works independently to solve problems. When they have some difficulties they ask a teacher or someone for help. The student wants to learn and understand how the problem is solved so they can solve similar ones.	*39.4%*	*44.5%*	*47.6%*
Level 4: The student likes to work independently on problems and after much effort and time he she might seek a hint from a teacher, friend or parent.	*21.2%*	*20.0%*	*14.9%*
Level 5: The student thrives on solving problems independently. After a great deal of time, checking notes, and diligence, they will ask for the slightest of hints. They want and are determined to solve the problem by themselves.	*13.4%*	*11.2%*	*13.5%*
Sufficient Standard Level	***3.0***	***3.1***	***3.1***
% expectation of standard-setters	***78%***	***83%***	***83%***
% of students meeting the standard	***74%***	***71%***	***71%***

Note 1 Number of Participating Students Grade 5: 1049, Grade 8: 437, and Grade 11: 520

Note 2 Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Figure 6 shows that:

- About three in four students in Saskatchewan persist to solve difficult problems independently and/or want to understand solutions for future applications.
- Grade 5 persistence results match the panelists' expectations, however Grade 8 and 11 results do not.

Support-Related Opportunities to Learn

The standard-setting panel considered two home support-related OTL elements.

- Support for students' learning, in general; and
- Support for learning mathematics.

General Support for Learning

A significant factor contributing to the success students experience in school is the support they receive from their parents or guardians. By reading to their children, helping with homework, assisting in finding resources, attending school events, being an advocate for their children's learning, and other forms of support, they contribute to their child's success at school.

Home support for learning in general, may include:

- *Providing a place for homework and quiet time*
- *Having discussions about school and learning*
- *Providing affirmation of their own identity and a sense of belonging to the family*
- *Reading to them*
- *Engaging in talking circles*
- *Setting high, but realistic expectations*
- *Giving encouragement*
- *Attending parent/teacher interviews*
- *Storytelling*
- *Having an achievement wall*

Figure 7: Home Support for Students' Learning in General, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Student Responses		
	Grade 5	Grade 8	Grade 11
Level 1: Parents don't know how to, or choose not to support their child's learning. Parent and child communication is minimal.	*3.5%*	*4.7%*	*10.9%*
Level 2: Parent support is reactionary and uneven. Parents rarely discuss their expectations or encourage their children, but do take pride in their child's accomplishments. The parent will usually attend parent-teacher interviews.	*8.6%*	*13.3%*	*10.9%*
Level 3: Parents try to provide support for their child's learning, but may not understand and ensure that their support meets their child's needs. Parents tell their child about the importance of school and their expectations.	*39.1%*	*41.9%*	*43.9%*
Level 4: Parents offer a very positive and supportive environment that reinforces their child's learning. Parents initiate most conversations and they consider the interests and abilities of the child when stating expectations.	*31.0%*	*25.8%*	*26.2%*
Level 5: Parents offer a very positive and supportive environment where their children are encouraged to ask school-related and life-related questions. The child appreciates this interest and shares his/her full range of feelings and experiences with their parents so that they can improve their learning.	*17.7%*	*14.2%*	*8.0%*
Sufficient Standard Level	***3.4***	***2.9***	***2.8***
% expectation of standard-setters	***75%***	***90%***	***85%***
% of students meeting the standard	***72%***	***84%***	***80%***

Note 1: Number of Participating Students: Grade 5: 1049, Grade 8: 437, and Grade 11: 520
Note 2: Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Figure 7 shows that:

- About 4 in 5 students in Saskatchewan have guardians clearly state their expectations and affirm the importance of school.
- Three-quarters of Grade 5 and over four in five Grade 8 and 11 students have sufficient home support for learning in general.

Support for Learning Math

Not only having general support for learning, but targeted support for learning math specifically will help the success students experience in mathematics at school. Playing games that develop numeracy skills at a young age, assisting with homework, and helping find resources that will benefit their child's mathematics learning are some ways that parents help their children learn math. Parents that communicate the importance of math and demonstrate where math is used to their children can help improve their child's attitude towards learning mathematics.

Figure 8: Home Support for Students' Learning in Mathematics, Grades 5, 8 and 11

Brief description of characteristics at each level ...	Frequency (%) of Student Responses		
	Grade 5	Grade 8	Grade 11
Level 1: *Parents do not communicate the importance of mathematics. They are unable to or choose not to help their child learn mathematics.*	*1.5%*	*5.2%*	*15.5%*
Level 2: *Parents communicate the importance of being good at mathematics and will sometimes help their child learn mathematics, but may give up quickly. They may cite that "I was never good at math either" and refer them to another person.*	*10.8%*	*23.0%*	*36.4%*
Level 3: *Parents communicate the importance of math and attempt to justify its importance when the occasion arises. They will help their child learn mathematics.*	*21.3%*	*29.7%*	*25.4%*
Level 4: *Parents communicate the importance and utility of math to their child. They enjoy helping their child develop their understanding of mathematics.*	*40.6%*	*29.9%*	*17.7%*
Level 5: *Parents communicate the importance and utility of math and encourage them to look for patterns and explore math concepts found in nature, work and play. They monitor their child's learning of mathematics.*	*25.9%*	*12.1%*	*5.0%*
Sufficient Standard Level	***3.1***	***3.0***	***3.0***
% expectation of standard-setters	***83%***	***83%***	***73%***
% of students meeting the standard	***86%***	***72%***	***49%***

Note 1: Number of Participating Students – Grade 5: 1049, Grade 8: 437, and Grade 11: 520
Note 2: Descriptions outlined in chart do not include all characteristics within the OTL rubric. *(Please refer to OTL rubric found on this website.)*

Figure 8 shows that:

- As students become older, the level of support at home for learning math decreases.
- Grade 5 results match the panelists' expectations related to support at home for learning math, however Grade 8 and 11 results do not.

Support at home for learning math, may include:

- *Providing a place for completing math homework*
- *Playing board or card games*
- *Pointing out math applications in real-life situations*
- *Asking math questions and encouraging exploration to finding their solutions*
- *Setting high, but realistic expectations*
- *Being positive about their own experience with learning mathematics*
- *Giving encouragement*
- *When helping with math homework, making sure their children understand how and why the math works*

Student Achievement

Introduction

In this section, achievement of Grade 5, 8, and 11 students is summarized. Results are provided for:

- overall achievement for the performance station test component;
- proficiencies in communicating mathematics understanding;
- comparison of achievement for an identical task between all grades; and,
- Grade 5 paper-and-pencil computation, multiple-choice, and problem-solving tasks.

Determining Student Achievement

We established mathematics criteria for five achievement levels. *Level 5* achievement is highest and *Level 1* achievement is lowest. The performance station and problem-solving tests gave students opportunity to attain any of these five levels.

For each student booklet the following was determined:

- achievement levels for each problem;
- an overall achievement level; and,
- a mathematics communication proficiency level.

In this section, results are displayed using bar graphs. The bars represent the percentage of students performing at a particular level of achievement. The assessment was designed to have *Level 3* achievement be acceptable or adequate performance for the grade level being assessed. Similar to the process undertaken for setting standards and expectations for the opportunity-to-learn elements, panelists were asked to indicate the expected percentage of students that should be able to complete questions at each performance level. The panelists' expectations are shown on the graphs with a triangle (▲).

In summary, standard-setting panelists decided on the percent of Saskatchewan students that should be performing at *Level 3* or above for the assessment tasks. Their decisions are represented by triangles ▲ on the performance achievement graphs. Performance at *Level 3* is deemed to be sound, good and consistent work.

- *Level 5* achievement is the best and most insightful work of our most capable students.
- *Level 4* achievement indicates high proficiency and application skills.
- *Level 3* achievement is sound, adequate, and consistent.
- *Level 2* achievement represents only basic understanding of routine mathematics and lacks consistency.
- *Level 1* achievement is limited and poor.

Performance Station Test Results

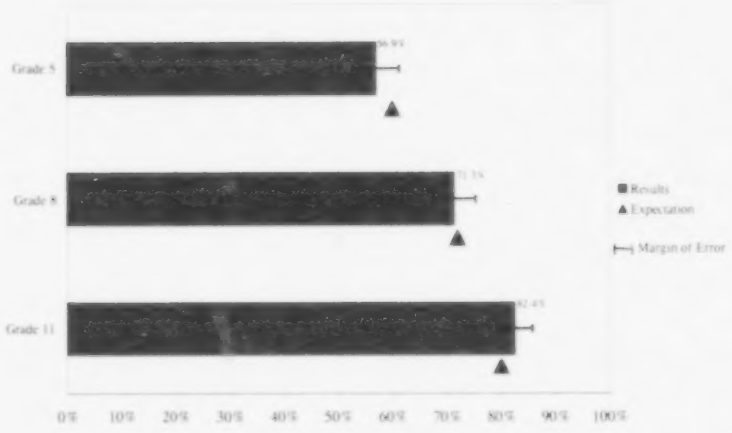
Performance-based tests at each of Grades 5, 8, and 11:

- included six stations which presented problem situations;
- provided materials (counters, blocks, dice, balances, rulers, shapes, etc.) to:
  - ➢ gather data to help solve the problem, or
  - ➢ manipulate to test strategies for solving the problem; and,
- allowed students to attain any one of the five achievement levels.

Access to the assessment tasks are available online and can be found at: http://www.sasked.gov.sk.ca/k/pecs/ae/plap.html

Students worked independently at each station. No direct observation of students occurred as they worked at the stations. Students' achievements were determined from their written responses, which may not have captured all of the thinking they engaged in at the performance stations.

Figure 9: Percentage Attaining Adequate Achievement Results (Level 3 or above), Performance-Based Component, Grades 5, 8 and 11



Reading the Grade 5 Results from the Graph

For Grade 5

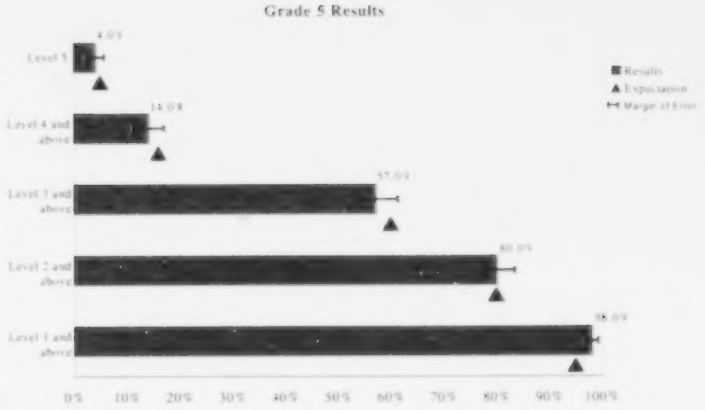
- Approximately 60% of the Grade 5 students were expected to score a *Level 3* or better on the test *(shown by ▲)*.
- Approximately 57% of the Grade 5 students scored *Level 3* or better *(end of horizontal bar)*.
- ⊢ Represents the margin of statistical error *(95% confidence)*. If the ▲ lies within, or to the left of the margin of error, student achievement has reached or exceeded provincial expectations.

Figure 9 shows:

- Almost three in five Grade 5 students are achieving adequate or better *(Level 3)* performance.
- Almost three in four Grade 8 students are achieving adequate or better *(Level 3)* performance.
- Over four in five Grade 11 students achieving adequate or better *(Level 3)* performance.

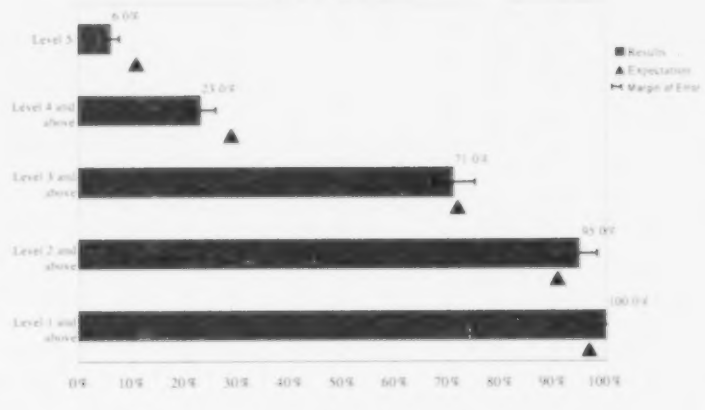
Overall, Grades 5, 8 and 11 students are meeting provincial expectations in their performance of mathematics at *Level 3* or above.

Figure 10: Performance-Based Achievement Results (Cumulative Results and Expectations)



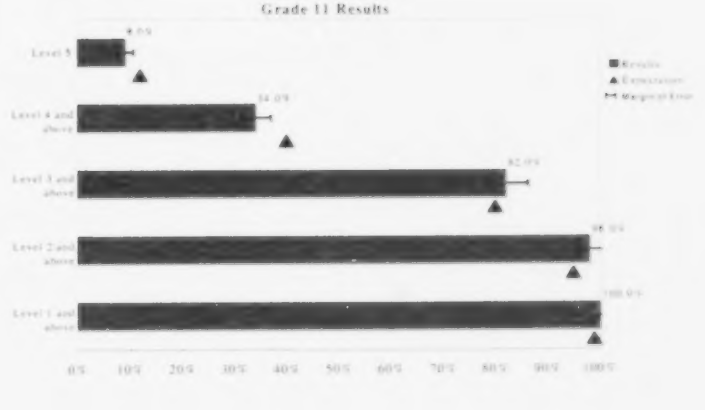
Highlights

- *Grade 5 students are meeting or exceeding expectations at all levels.*
- *Approximately one out of seven Grade 5 students are performing at Level 4 or above.*



Highlights

- *Grade 8 students are not meeting expectations at the higher levels of achievement.*
- *Approximately three out of four Grade 8 students are performing at Level 3 or above.*



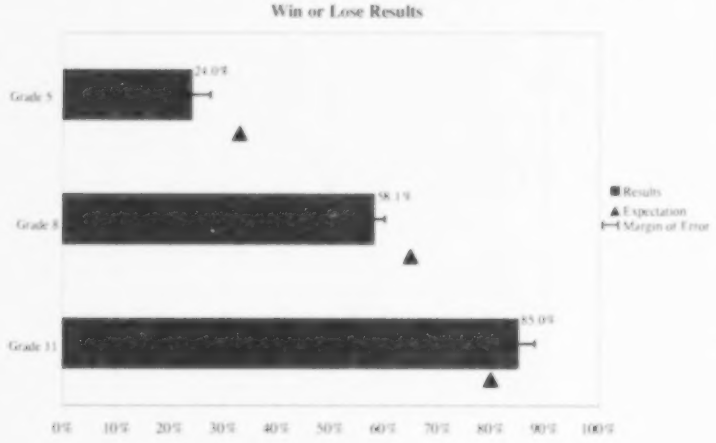
Highlights

- *Grade 11 students are not meeting expectations at the higher levels of achievement.*
- *Approximately four out of five Grade 11 students are performing at Level 3 or above.*

Results of a Common Task Among Grades 5, 8 and 11

During the performance station test, students in Grades 5, 8 and 11 undertook six tasks. The Grade 5 and Grade 8 students were given two common tasks and the Grade 8 and Grade 11 students had three tasks in common. One of the tasks *(Win or Lose)* was common to all three grades. The *Win or Lose Station* asked students to gather and tally data from 30 rolls of two 8-sided dice and then graph the results. The last two questions of the challenge extended students' thinking to theoretical probability and game criteria.

Figure 11: Results of Win or Lose Performance Station, Grades 5, 8 and 11



Reading the Grade 5 Results from the Graph

For Grade 5

- Approximately one-third of the Grade 5 students were expected to score a *Level 3* or better on the test *(shown by ▲)*.
- Approximately one-quarter of the Grade 5 students scored *Level 3* or better *(end of horizontal bar)*.

⊢ Represents the margin of statistical error *(95% confidence)*. If the ▲ lies within, or to the left of the margin of error, student achievement has reached or exceeded provincial expectations.

As one would expect, Grade 11 students outperformed Grade 8 students and Grade 8 students outperformed Grade 5 students on the common task, *Win or Lose*. When other common task results were tabulated (Grade 5/Grade 8 - one other task and Grade 8/Grade 11 - two other tasks) similar findings were found. The higher grade outperformed the lower grade.

Figure 12: Results of Win or Lose Performance Station - Summary of Results and Expectations

	Level 5		***Level 4+***		***Level 3+***		***Level 2+***		***Level 1+***	
	Expected	*Actual*	*Expected*	*Actual*	*Expected*	*Actual*	*Expected*	*Actual*	*Expected*	*Actual*
Grade 5	*5%*	*3%*	*10%*	*9%*	*33%*	*24%*	*85%*	*86%*	*90%*	*93%*
Grade 8	*10%*	*12%*	*25%*	*20%*	*65%*	*58%*	*95%*	*97%*	*98%*	*99%*
Grade 11	*30%*	*31%*	*50%*	*47%*	*80%*	*85%*	*99%*	*99%*	*100%*	*100%*

Students in all three grades met expectations at all levels except for one case. The Grade 5 students did not meet expectations at *Level 3*. To be deemed *Level 3* at the *Win or Lose* station students had to draw a correct graph, that was adequately scaled and labeled, clearly communicating the meaning of the data they had collected from rolling the dice. One in four students in Grade 5 drew the graph to this criterion, however one in three students were expected to do this. In Grade 8 almost two in three students, and in Grade 11 almost nine in ten students achieved *Level 3* performance or better.

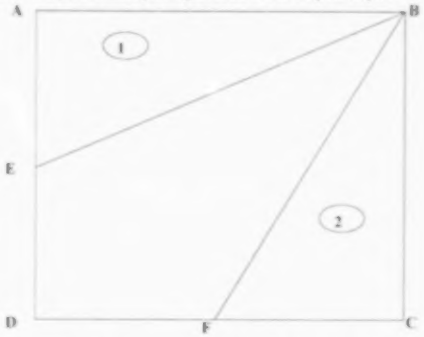
Results of Mathematics Communication Grades 5, 8 and 11

Demonstrating that you have learned mathematics involves much more than just stating the right answer to questions. Thought processes undertaken by students to solve problems are as important, if not more important to mathematics learning than just providing correct answers. Students offering solutions to teachers that are well communicated mathematically, not only help their teachers identify possible thinking errors in the students' solutions, but help bring to them a personal understanding and meaning for their mathematics learning.

Examples of proficiencies in students' mathematics communication

We asked Grade 5 and 8 students to describe their solutions to the following.

2. We can move objects from one location to another using *translations* (slides), *rotations* (turns), and/or *reflections* (flips). Describe the steps needed to move a triangle from triangle position 1 to triangle position 2 as shown on the square below. The plastic overlay triangle at this station may be helpful.



Write the description of the steps you used in as much detail as possible.

Thought and communication is how students bring order and meaning to facts and experiences. Students that are offered opportunities to express their mathematics understanding with oral and written words in classrooms are more apt to reflect and make personal connections to their learning. Through this communication process, a deeper understanding and transference of mathematical concepts is possible for students. In mathematics classrooms students should use thought and language to ask questions, discuss ideas, explore alternate strategies and justify conclusions. Teachers could improve students understanding of the mathematics concepts taught by asking students to document their thinking in journals or reports and clarify and explain their reasoning on tests.

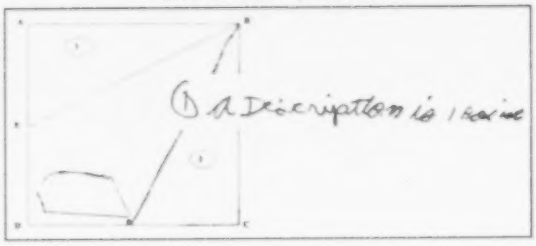
Judging Written Communication in Mathematics

Four categories were used to describe students' written communication in mathematics: *Beginning Communication*, *Developing Communication*, *Adequate Communication*, and *Proficient Communication*. Scorers examined criteria and grade-appropriate student examples when judging students' levels of communication proficiency.

Grade 9 Examples for the Different Performance Levels of Communication (Scenario 2 - Shape, Hope, and Turns)

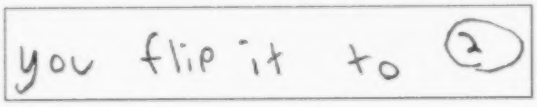
Students with ***Beginning Communication*** skills in mathematics:

- follow directions poorly;
- show little or no work; and,
- submit work that is disorganized and confusing.



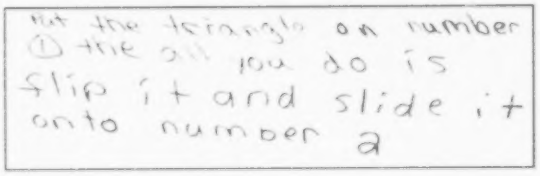
Students with ***Developing Communication*** skills in mathematics:

- follow directions, but not to completion;
- do not consistently show work when requested; and,
- submit work that requires effort to infer what they are thinking.



Students with ***Adequate Communication*** skills in mathematics:

- follow directions to completion;
- show work and offer explanations or illustrations when requested; and,
- submit work that is organized and easy to follow.



Students with ***Proficient Communication*** skills in mathematics:

- communicate clearly, precisely and effectively;
- consistently show the details of their work and elaborate upon their steps, strategies and examples; and,
- submit work that is well-organized and very easy to follow.

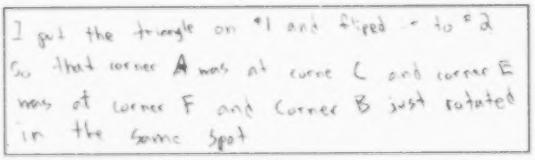
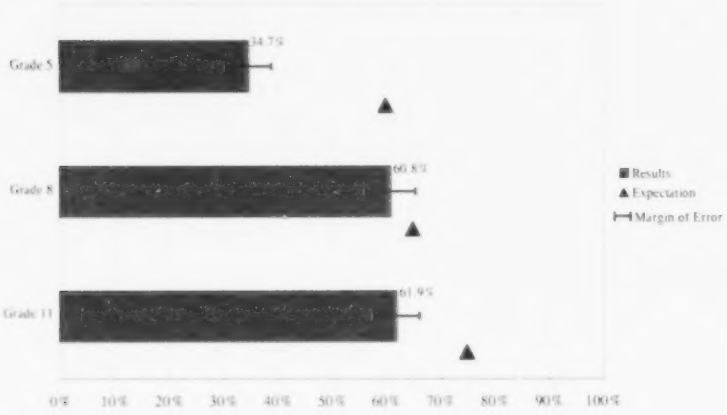

I put the triangle on #1 and flipped it to #2 so that corner A was at corner C and corner E was at corner F and Corner B just rotated in the same spot

Figure 13: Communication in Mathematics Adequate (or Better) Achievement Results, Grades 5, 8 and 11



Reading the Grade 5 Results from the Graph

For Grade 5

- Three in five Grade 5 students were expected to score Adequate or better on their communication skills *(shown by ▲).*
- Approximately one third of the Grade 5 students scored *Adequate* or better *(end of horizontal bar).*

⊢ Represents the margin of statistical error *(95% confidence).* If the ▲ lies within, or to the left of the margin of error, student achievement has reached or exceeded provincial expectations.

Figure 13 shows:

- Fewer than expected Grade 5 students are communicating at an adequate level in mathematics.
- Grade 8 students are approaching the expected levels in mathematics communication skills. Approximately three in five Grade 8 students are communicating at an adequate level or better.
- Fewer than expected Grade 11 students are communicating at an adequate level in mathematics.

Overall, the results from this aspect of the assessment were of concern to the standard-setters, especially at the Grade 5 level. They want and expect more Saskatchewan students to improve their skills in communicating their ideas within a mathematical context.

Figure 14 illustrates the expected and actual results for mathematics communication at each of the four levels of communication. Figure 14 highlights that:

- Fewer than expected Grade 5, 8 and 11 students were achieving proficient levels of communication in mathematics.

Figure 14: Results from Communication in Mathematics - Summary of Results and Expectations

	Proficient		***Adequate or better***		***Developing or better***		***Beginning or better***	
	Expected	*Actual*	*Expected*	*Actual*	*Expected*	*Actual*	*Expected*	*Actual*
Grade 5	*15%*	*4%*	*60%*	*35%*	*85%*	*85%*	*100%*	*100%*
Grade 8	*30%*	*12%*	*66%*	*61%*	*94%*	*96%*	*100%*	*100%*
Grade 11	*40%*	*14%*	*75%*	*62%*	*95%*	*94%*	*100%*	*100%*

In 1997, a provincial learning assessment similar in nature to the 2001 assessment was administered in Saskatchewan. To make comparisons between the achievement results, performance and problem-solving tasks common to 1997 and 2001 that were re-scored using the 2001 methodology. Figure 15 summarizes these results and identifies performance differences of 5% or more between the two assessments.

Task	Percentage of Students									
	Level 1*		Level 2*		Level 3*		Level 4*		Level 5	
	1997*	2001	1997*	2001	1997*	2001	1997*	2001	1997*	2001
Grade 5 - Win or Lose	91*	92*	83.6	86.3	23*	24.2	8.1	9.3	2.2	3.0
Grade 5 - Slides, Flips and Turns	98.3	98.8	69.0	70.5	32.2	31.6	8.4	6.1	4.8	4.1
Grade 5 - Putting the Pieces Together	**81.3**	**88.0**	63.8	64.3	40.8	42*	6.9	10.0	1.5	1.9
Grade 5 - Pass the Pasta	97.5	98.4	74.0	77.3	**52.2**	**58.0**	33.6	32*	9.1	10.3
Grade 5 - Important Change	94.8	97.6	89.2	91.5	55*	55.3	47.1	46.1	17.3	15.6
Grade 5 - The Greater Product Problem	98.6	98.9	94.8	93.4	45.0	44.4	30.4	31.5	12	17
Grade 5 - Talking About Shapes	86.5	84.6	53*	58.9	**19.4**	**25.7**	1.5	3.7	0.0	0.2
Grade 5 - A Piece of the Action	91.1	87.6	**83.6**	**72.6**	44.1	48.3	8.2	7.1	1.8	0.8
Grade 5 - Boy am I Hungry!	**84.4**	**92.7**	78.2	82.8	62.6	61*	**24.8**	**29.8**	1.4	2.6
Grade 8 - Win or Lose	97.1	98.6	95.4	97.3	53.4	58.2	20.2	20.5	11.9	12.0
Grade 8 - Slides, Flips and Turns	99*	99.8	91.3	92.5	59.9	61.6	27.8	25.0	16.8	15.0
Grade 8 - That's Only Part of It	98.6	98.5	88.8	91.8	**61.2**	**68.8**	**26.6**	**35.8**	0.8	2.1
Grade 8 - What do I Wear?	87.0	87.0	**69.1**	**74.3**	58.8	63.3	38.6	41*	4.3	8.2
Grade 8 - Sim Solids	95*	99.1	91.3	95.0	**51.1**	**57.9**	15.6	19.6	1.2	3.2
Grade 11 - Win or Lose	100.0	99.8	99.2	99.4	80.1	84.6	42.9	46.6	31.1	30.8
Grade 11 - Sneaky Shapes	98.1	99.2	93.6	97.3	**76.8**	**84.4**	28*	32.5	6.2	8.1
Grade 11 - Flipping Tiles and T Patterns	95.1	94.0	86.8	86.0	63*	59.8	46.5	47*	3.1	0.8
Grade 11 - What do I Wear?	91*	94.0	86.2	89.2	83*	85*	69.4	70.3	17.0	19.1
Grade 11 - Sim Solids	99.6	99.2	98*	98.5	82.1	81.5	43.0	44.4	10.1	9.8

	Beginning*		Developing*		Adequate*		Proficient	
Grade 5 - Communication	100	100	80.5	85.0	33.1	34*	5.5	3*
Grade 8 - Communication	100	100	**90.5**	**95.9**	**48.4**	**60.8**	**6.3**	**11.6**
Grade 11 - Communication	100	100	92.6	94.4	**51.5**	**61.9**	**5.3**	**14.0**

Note 1: The comparison results are based on only those students that attempted the task.

Note 2: Differences identified in ***bold italics*** indicate that students in 2001 performed better than their 1997 counterparts. Differences identified in *italics* indicate that students in 1997 performed better than their 2001 counterparts.

Note 3: A 5% difference in performance does not necessarily indicate that the difference in performance is statistically different.

Note 4: Communication results are reported in a cumulative fashion. That is, all students (100%) were assessed Beginning Level or better, a smaller percentage would be expected to be performing at the Developing Level or better, yet even smaller percentage of students would be expected to be performing at the Adequate Level or better, and the lowest percentage would be expected to be performing at the Proficient Level.

Comparison of Performance Station Test Results between 1997 and 2001, Grades 5, 8 and 11

In 1997, a provincial learning assessment similar in nature to the 2001 assessment was administered in Saskatchewan. To make comparisons between the achievement results, performance and problem-solving tasks common to 1997 and 2001 that were re-scored using the 2001 methodology. Figure 15 summarizes these results and identifies performance differences of 5% or more between the two assessments.

Figure 15: Comparison Results between 1997 and 2001

Task	Percentage of Students									
	Level 1*		Level 2*		Level 3*		Level 4*		Level 5	
	1997	2001	1997	2001	1997	2001	1997	2001	1997	2001
Grade 5 - Win or Lose	91.7	92.7	83.6	86.3	23.7	24.2	8.1	9.3	2.2	3.0
Grade 5 - Slides, Flips and Turns	98.3	98.8	69.0	70.5	32.2	31.6	8.4	6.1	4.8	4.1
Grade 5 - Putting the Pieces Together	[illegible]		63.8	64.3	40.8	42.7	6.9	10.0	1.5	1.9
Grade 5 - Pass the Pasta	97.5	98.4	74.0	77.3	[illegible]		33.6	32.7	9.1	10.3
Grade 5 - Important Change	94.8	97.6	89.2	91.5	55.7	55.3	47.1	46.1	17.3	15.6
Grade 5 - The Greater Product Problem	98.6	98.9	94.8	93.4	45.0	44.4	30.4	31.5	1.2	1.7
Grade 5 - Talking About Shapes	86.5	84.6	53.7	58.9	[illegible]		1.5	3.7	0.0	0.2
Grade 5 - A Piece of the Action	91.1	87.6	[illegible]		44.1	48.3	8.2	7.1	1.8	0.8
Grade 5 - Boy am I Hungry!	[illegible]		78.2	82.8	62.6	61.7	[illegible]		1.4	2.6
Grade 8 - Win or Lose	97.1	98.6	95.4	97.3	53.4	58.2	20.2	20.5	11.9	12.0
Grade 8 - Slides, Flips and Turns	99.7	99.8	91.3	92.5	59.9	61.6	27.8	25.0	16.8	15.0
Grade 8 - That's Only Part of It	98.6	98.9	88.8	91.8	[illegible]		[illegible]		0.5	2.1
Grade 8 - What do I Wear?	87.0	87.0	[illegible]		58.8	63.3	38.6	41.7	4.3	8.2
Grade 8 - Sim Solids	95.7	99.1	91.3	95.0	[illegible]		15.6	19.6	1.2	3.2
Grade 11 - Win or Lose	100.0	99.8	99.2	99.4	80.1	84.6	42.9	46.6	31.1	30.8
Grade 11 - Sneaky Shapes	98.1	99.2	93.6	97.3	[illegible]		28.7	32.5	6.2	8.1
Grade 11 - Flipping Tiles and # Patterns	95.1	94.0	86.8	86.0	63.7	59.8	46.5	47.7	1.1	0.8
Grade 11 - What do I Wear?	91.7	94.0	86.2	89.2	83.7	85.7	69.4	70.3	17.0	19.1
Grade 11 - Sim Solids	99.6	99.2	98.7	98.5	82.1	81.5	43.0	44.4	10.1	9.8

	Beginning*		Developing*		Adequate*		Proficient	
Grade 5 - Communication	100	100	80.5	85.0	33.1	34.7	5.5	3.7
Grade 8 - Communication	100	100	[illegible]		[illegible]		[illegible]	
Grade 11 - Communication	100	100	92.6	94.4	[illegible]		[illegible]	

Note 1: The comparison results are based on only those students that attempted the task.

Note 2: Differences identified in green indicate that students in 2001 performed better than their 1997 counterparts. Differences identified in red indicate that students in 1997 performed better than their 2001 counterparts.

Note 3: A 5% difference in performance does not necessarily indicate that the difference in performance is statistically different.

Note 4: Communication results are reported in a cumulative fashion. That is, all students (100%) were assigned Beginning Level or better, a smaller percentage would be expected to be performing at the Developing Level or better, an even smaller percentage of students would be expected to be performing at the Adequate Level or better, and the lowest percentage would be expected to be performing at the Proficient Level.

Overall, there were few statistically significant differences in performance outcomes between the 1997 and 2001 assessment results. Generally speaking, when there were differences, the results from the 2001 assessment were better than these of the 1997 assessment. For example, when examining the communication in mathematics results, Grade 8 and 11 students in 2001 consistently outperformed their 1997 counterparts at the higher levels of achievement.

Grade 5 Paper-and-Pencil Component

Grade 5 paper-and-pencil tests, written by more than 500 students included:

- a student questionnaire;
- an 8-item computation test;
- a 40-item multiple-choice test; and,
- a test with six extended problems.

Students finished these over a two-day period. The first day they completed computations and multiple-choice items. The second day they wrote the problem-solving test.

Computation Skills

Students performed eight computations without a calculator. They did four computations involving whole numbers and four involving decimal numbers. The computations required students to add, subtract, multiply, and divide. Achievement standards were not set for these computation skills. Without provincial expectations, readers must draw their own conclusions about the adequacy of Grade 5 students' computation skills.

Grade 5 Computation Questions

a) $4\,357 + 2\,435$

b) $68.79 + 4.53 + 22.86$

c) $4\,012 - 2\,654$

d) $9.42 - 5.7 =$

e) 31.07×6

f) $30 \times 4 \times 2 =$

g) $6\overline{)4\,215}$

h) $3\overline{)18.66}$

Figure 16: Grade 5 Computation Skill Results by Question Type 1997 and 2001

	Whole Numbers		*Decimal Numbers*	
	1997	*2001*	*1997*	*2001*
Addition	*93%*	*93%*	*68%*	*69%*
Subtraction	*69%*	*64%*	*40%*	*36%*
Multiplication	*63%*	*63%*	*62%*	*59%*
Division	*56%*	*50%*	*49%*	*44%*

Note: Percentages show the proportion of students correctly answering each type of question

Figure 16 shows:

- Students experienced more success performing computations with whole numbers than with decimal numbers.
- Students performed better in addition and multiplication and poorer in subtraction and division.
- Comparing students' performance between 1997 and 2001, there were no statistical differences in results. When there were differences students generally performed better in 1997.

Figure 17: Grade 5 Computation Skills Frequency Distribution, 1997 and 2001

	1997	*2001*
8 correct	*9.3%*	*8.0%*
6-7 correct	*36.3%*	*32.5%*
4-5 correct	*32.8%*	*32.3%*
2-3 correct	*16.9%*	*22.0%*
0-1 correct	*4.7%*	*5.2%*
Average # Correct	*5.07*	*4.81*

Note: Percentages show the proportion of students achieving the specified number of correct responses

Figure 17 displays Grade 5 students' overall computation proficiency. It shows that in 2001:

- About one in twelve Grade 5 students scored perfectly on the computation test.
- Approximately three in four students had at least four computations correct
- The overall average computation proficiency score was lower than in the 1997 assessment, but this difference was not statistically significant *(95% confidence level)*.

Mathematical Content Skills

Grade 5 students wrote a 40-question multiple-choice test. The test measured students' understanding of mathematics concepts, procedures, and relationships. Contextual clues in the form of diagrams and situations were provided for several questions.

Figure 18: Grade 5 Multiple-Choice Test Results, 1997 and 2001

Strand	*Average Score*		*Top 10%*		*Top 25%*		*Top 50%*	
	1997	*2001*	*1997*	*2001*	*1997*	*2001*	*1997*	*2001*
Whole Numbers	62%	59%	92%	90%	75%	70%	67%	60%
Fractions and Decimals	35%	45%	67%	70%	44%	60%	33%	40%
Geometry	41%	40%	67%	67%	50%	50%	33%	33%
Measurement	56%	60%	88%	89%	75%	78%	63%	67%
Data Management	68%	68%	100%	100%	80%	80%	80%	80%
Overall	**52%**	**54%**	**73%**	**75%**	**63%**	**65%**	**53%**	**55%**

Note 1: Caution should be undertaken when comparing the 1997 results to the 2001 results. Two questions were replaced with different questions and 5 other questions were modified to some degree. Further, the number of questions within each strand was not consistent from the 1997 to 2001 assessments.

Note 2: The last six columns indicate the minimum percentages that students in the *Top 10%*, *Top 25%* and *Top 50%* categories had correct in each strand. For example, a student with at least 73% of the questions correct in 2001 would be in the Top 10% of performers for that assessment.

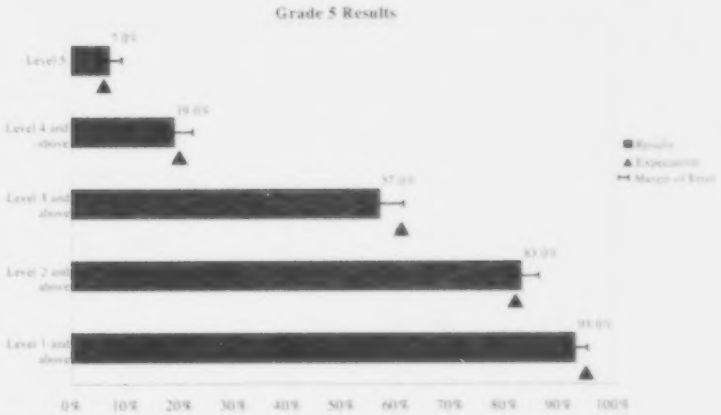
Figure 18 shows:

- In both 1997 and 2001 students had difficulty with this test.
- There were no significant statistical *differences (95% confidence level)* between results from 1997 to 2001.
- A student needed to answer 30 out of 40 questions correct to be in the top 10% of performers.
- *Geometry* and *Fractions/Decimals* strands were areas of lowest achievement. Approximately one in three students answered at least half of these questions correctly.
- Over 15% of the students had all the data management questions correct. This number dropped to below 6% answering all the measurement questions correct. Fewer than 1% of the students answered all the questions in any of the other three strands correctly.

Problem-Solving Skills

Grade 5 students also completed six extended problems. These were similar in structure to the tasks in the performance station test, except students did not have hands-on manipulatives to use when solving the problems.

Figure 19: Problem-Solving Achievement Results, Grade 5



Highlights

- *Grade 5 students are meeting expectations at all levels of achievement.*
- *About four in five Grade 5 students are performing at Level 2 or above.*

The graph above shows:

- Grade 5 results met provincial expectations for solving extended problems. About three in five students showed such proficiency *(Levels 3-5)*.
- At higher or more proficient levels of performance *(Levels 4-5)*, approximately one in five students demonstrated such performance.

These results are similar to those attained in the Grade 5 performance station test *(see page 13)*.

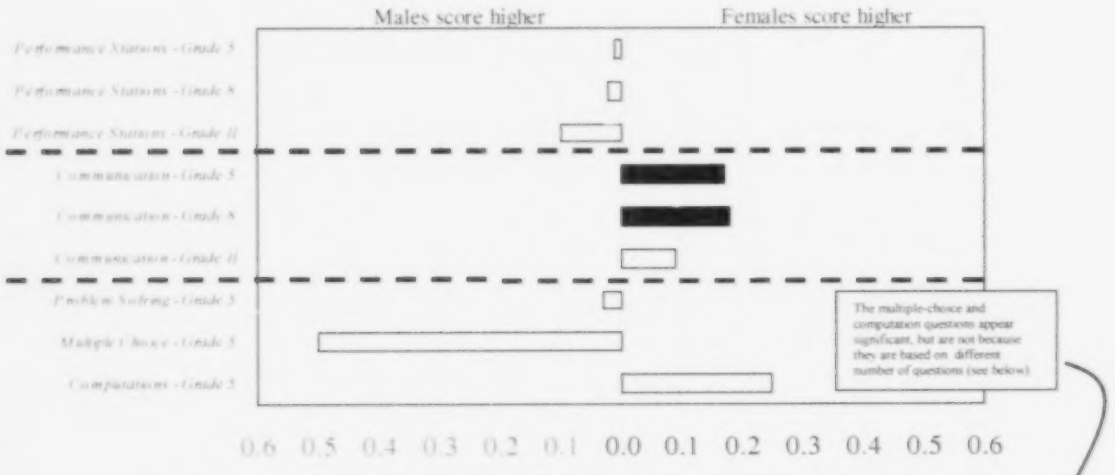
Student Achievement, Attitudes, and Practices

Gender Differences in Achievement

There were 975 males *(49.6%)* and 992 females *(50.4%)* that participated in the provincial mathematics learning assessment. Comparing the overall level attainment results on the performance station test of the assessment, there were no significant statistical differences between males and females over the three grades.

When comparing mathematical communication skills between males and females, there were significant differences in favour of the females at two of the three grades tested. Grade 11 results indicated females did score better than males, but this difference was not statistically significant.

Figure 20: Gender Differences in Student Achievement


Males score higher
Females score higher
Performance Stations - Grade 5
Performance Stations - Grade 8
Performance Stations - Grade 11
Communication - Grade 5
Communication - Grade 8
Communication - Grade 11
Problem Solving - Grade 5
Multiple Choice - Grade 5
Computations - Grade 5
The multiple-choice and computation questions appear significant, but are not because they are based on different number of questions (see below).
0.6 0.5 0.4 0.3 0.2 0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6
Differences in Average Performance Between Males and Females

Note 1 Bars represent the difference in the average performance level between males and females. For example, Grade 11 males scored on average 0.10 of a level higher on the performance-based component than Grade 11 females.

Note 2 Computation scores were not based on levels, but on the number of questions correct out of 8. In this assessment, Grade 5 females scored on average 0.25 questions more correctly than Grade 5 boys.

Note 3 Multiple-choice scores were not based on levels, but on the number of questions correct out of 40. In this assessment, Grade 5 males scored on average 0.5 questions more correctly than Grade 5 girls.

Note 4 Communication scores were based on a 4-level rubric as compared to a 5-level rubric to the performance based and Grade 5 problem-solving components.

Indicates difference is significant

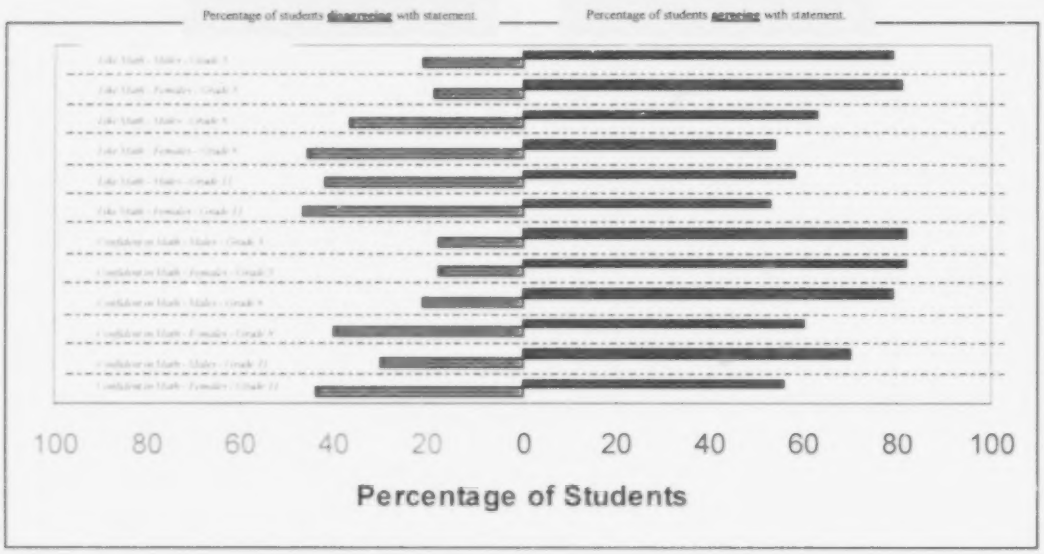
Indicates difference is not significant *(overlapping of confidence interval test - 95% confidence)*

Students' Attitudes in Mathematics

We asked students to strongly agree, agree, disagree, or strongly disagree to the following statements:

- *I like mathematics.*
- *I feel confident when I do mathematics questions.*

Figure 21: Students' Attitudes towards and Confidence in Mathematics



Note: In all three grades, more students agreed with the two statements presented then disagreed.

Figure 21 shows:

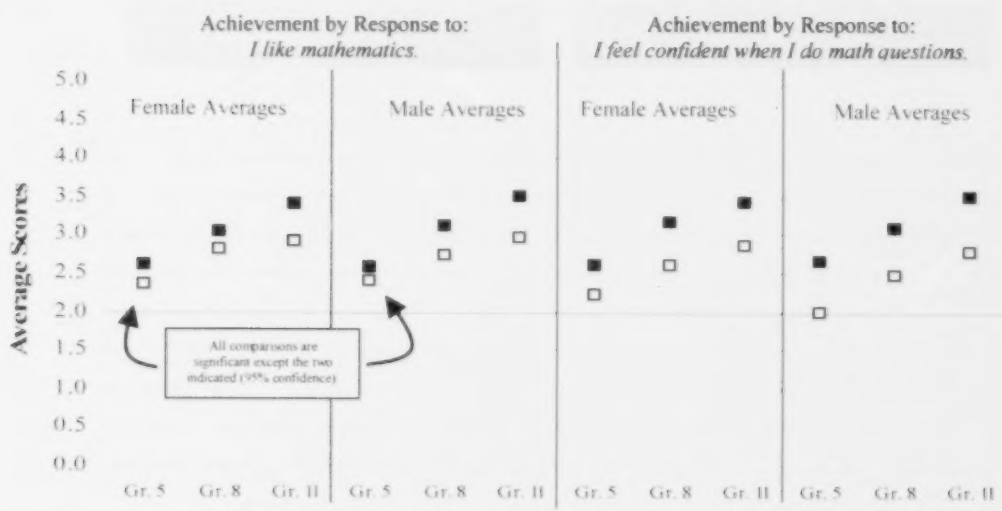
- Most Grade 5 students like mathematics and are confident in their abilities. Such numbers decrease in Grades 8 and 11.
- Except for in Grade 5, fewer females indicate they like mathematics as much as males.
- Except for in Grade 5, females indicate they are less confident than males in their mathematical abilities.

Students who like mathematics achieved higher scores than those who do not. A strong relationship exists between achievement and how well students like mathematics and the confidence they have in their mathematical abilities.

Within this section of the report, discussions about relationships between achievement and various characteristics are presented. Although these findings from the assessment may be useful to discuss, one must take care to establish causal relationships.

Figure 22 illustrates how achievement scores vary with attitude and gender. A short line between symbols indicates that achievement was similar between groups. Longer lines between the symbols indicate that achievement does vary more with attitudes.

Figure 22: Average Achievement Level, by Attitude and Gender, Grades 5, 8 and 11



Note 1: ■ Strongly Agree or Agree □ Strongly Disagree or Disagree

Note 2: All but two differences were statistically different (95% confidence level).

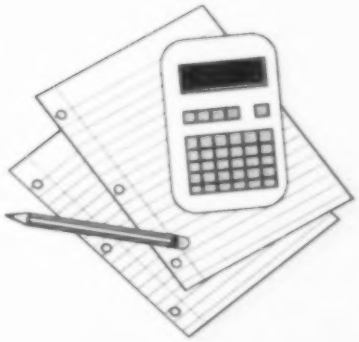
Figure 22 shows that:

- Both for Grade 5 females and males, average achievement levels do not differ between groups that like or don't like mathematics. In both Grades 8 and 11, average achievement levels do differ between groups that like and don't like mathematics. Students who like mathematics had a higher average score than those students that indicated they did not like mathematics.

- Students who indicated they were confident when doing mathematics questions had a higher average score than students who indicated they were not confident doing mathematics.

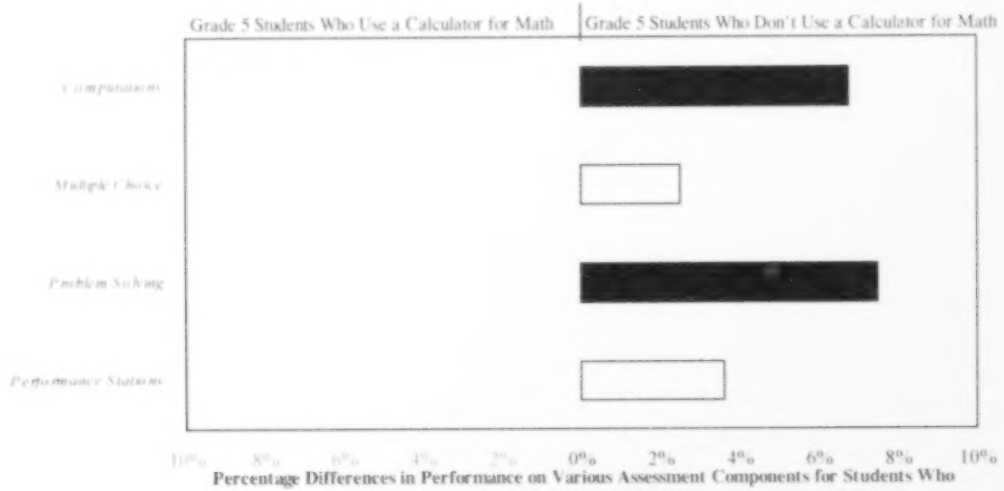
Calculator Use and Computation Skills

We asked students to indicate where they used calculators for mathematics. The last option provided to students was ***"I don't use a calculator for mathematics"***. A small number of Grade 8 students (23) and Grade 11 students (17) checked this response. Due to the low number of Grade 8 and 11 students that checked this response, no analysis was completed for these grades.



Approximately one-third of the Grade 5 students (172) indicated that they did not use a calculator for mathematics while the other two-thirds of the students said they used a calculator either at home or at school for mathematics.

Figure 23: Grade 5 Students' Performance and Calculator Use



Percentage Differences in Performance on Various Assessment Components for Students Who Use a Calculator and Those Who Don't Use a Calculator for Mathematics

Note 1: Bars represent the percentage difference in the average performance between students who did not use calculators for math and students that did. For example students who do not use a calculator for math scored on average 6.75% higher on the 8 computation questions than students who do use calculators at home and/or at school for math.
Note 2: Multiple-choice results were based on 40 questions.
Note 3: Problem Solving and Performance stations were based on a 5-level rubric score.

Indicates difference is significant
Indicates difference is not significant *(overlapping of confidence interval test - 95% confidence level)*

Figure 23 shows that Grade 5 students who do not use calculators for mathematics performed better in the assessment. However, the results from 1997 assessment related to calculator use and achievement showed no such differences. The use of calculators and student achievement is not clear. Future provincial assessments will continue to monitor student calculator use and student achievement in mathematics.

Readiness-Related Opportunity-to-Learn and Achievement

Students who are committed and prepared to learn present themselves with a better opportunity to learn. Completing homework assignments, bringing requested materials to class, persisting to a high degree when solving difficult problems, and thinking about how they might do things differently to improve their learning will positively affect their educational experience.

One 5-level, readiness-related opportunity-to-learn rubric describes how well students are prepared and committed to learn (*see pages 6-8*). The average performance level achieved by students with preparation and commitment to characteristics described by *Level 3* or *better (65% of the students)* was significantly higher than by students with characteristics of *Level 2* or below *(35% of the students)*.

Similarly, there were differences when comparing achievement results of students with a high degree of persistence when solving difficult problems to students with a lower degree of persistence. The average performance level achieved by students with persistence characteristics described by *Level 3* or *better (74% of the students)* was significantly higher than by students with persistence characteristics of *Level 2* or below *(26% of the students)*.

Figure 24: Average Achievement Level Differences, Low and High Readiness-Related OTL Groups, Grades 5, 8 and 11

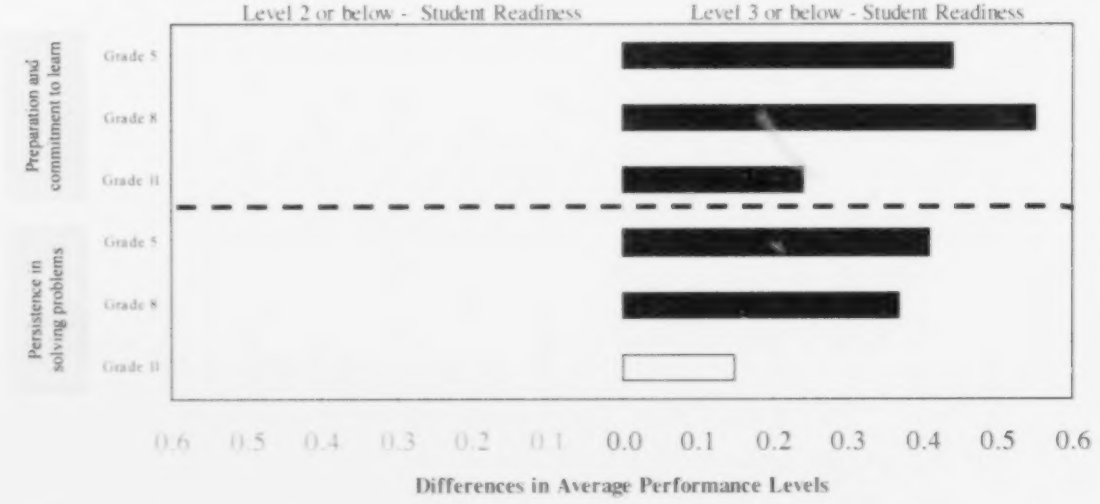

Level 2 or below - Student Readiness
Level 3 or below - Student Readiness
Preparation and commitment to learn
Grade 5
Grade 8
Grade 11
Persistence in solving problems
Grade 5
Grade 8
Grade 11
0.6 0.5 0.4 0.3 0.2 0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6
Differences in Average Performance Levels
Indicates difference is significant (95% confidence level)
Indicates difference is not significant

Figure 24 shows

- Grade 5, 8 and 11 students that are prepared and committed to learn (described by *Level 3)* or above have a higher average level of attainment in performance.
- On average, higher levels of commitment and preparation by students of Grade 8 affect levels of performance by approximately one-half of a level. This difference was the greatest among the three grades.
- Grade 5 and 8 students that persist to a high degree (described by *Level 3* or above) perform at a higher average level of attainment. Grade 11 students with these characteristics also perform at a higher average level, but these differences are not statistically significant *(95% confidence level).*

Other Student Related Findings

A number of factors influence the time students spend doing homework. These include teacher expectations, the nature and purpose of the homework, the abilities of the student, and the discipline and coping skills of the student. Generally, approximately 50% of the students in Saskatchewan spend less than one hour per week doing mathematics homework.

Figure 25: Percentage of Students Spending One Hour or Less on Math Homework in a Week, Grades 5, 8 and 11

	Gr. 5	Gr. 8	Gr. 11
No math homework or some, but less than 1 hour	*49%*	*58%*	*45%*

Students were presented with a number of statements related to mathematics and learning and asked to mark all that applied to them. Figure 26 summarizes some of this data.

Figure 26: Student Attitudes and Practices

Statement	*Percentage of students that indicated that the statement applied to them*		
	Grade 5	***Grade 8***	***Grade 11***
I have a portfolio/folder for my math work	*36%*	*20%*	*15%*
I like working with numbers more than words.	*60%*	*48%*	*43%*
I like working in small groups in math class.	*66%*	*75%*	*65%*
Learning math is stressful	*28%*	*40%*	*52%*
I think math is important to learn	*85%*	*77%*	*71%*
I like to learn new math ideas by working on difficult problems	*48%*	*23%*	*21%*

Note: Number of Participating Students – Grade 5: 1049, Grade 8: 437, and Grade 11: 520

Figure 26 shows:

- As students progress through the school system they tend to not like working with numbers as much as words and they find learning math more stressful. Approximately one-half of the Grade 11 students indicated they found learning math stressful.
- The majority of students like working in small groups in math class and think math is important to learn.
- Approximately one-half of Grade 5 students and one-quarter of Grade 8 and 11 students like to learn math by solving difficult problems.
- As students progress through the school system they tend not to maintain a portfolio/folder for their math work. Approximately one in three Grade 5 students, one in five Grade 8 students, and one in six Grade 11 students maintain math portfolios.

General Support for Learning and Achievement

Students who have general support at home for their learning perform better than students who do not have this general support (*see pages 10-11 for rubric*). The average performance level achieved by students with general support at home characteristics described by *Level 3* or *better (82% of the students)* was significantly higher than by students with general support at home characteristics of *Level 2* or below *(19% of the students)*.

Students that indicate they have more specific support for their math learning as described by the rubrics may or may not perform better *(see pages 10-11 for rubric)*. The average performance level achieved by students with math support at home characteristics described by *Level 3* or *better (68% of the students)* was not different than by students with math support at home characteristics of *Level 2* or below *(32% of the students)*.

Students that receive more specific mathematics support from home may be students that are greatly challenged by the learning of mathematics. If the home supports for mathematics were not in place or were not occurring for these students, they may not have performed as well.

Figure 27: Support-Related OTL and Achievement

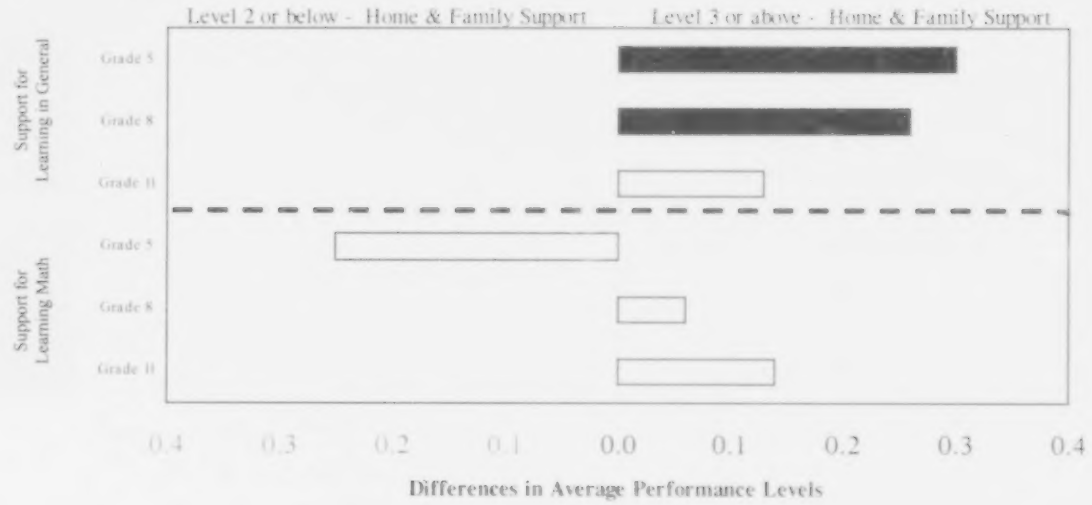


Figure 27 shows that:

- Students who have general home support for learning perform better than students who do not.
- Performance differences between students who have general home support and those that don't decrease as they progress through the school system.

Teacher Pre-Service and Achievement

Pre-service training of teachers is an important component in developing a strong and resourceful teaching force in Saskatchewan. While attending university, teachers gain background knowledge related to teaching and learning and are exposed to many different assessment and instructional strategies that serve them well during their teaching careers. In addition, during their pre-service training, teachers have the opportunity to specialize in certain content areas. Teachers might prepare for teaching mathematics either through completing mathematics instructional methodologies classes and/or mathematics content classes (statistics, calculus ...etc.).

Figure 28 shows the percentage of teachers that completed pre-service courses to become specialized in mathematics *(see page 32)*. For this summary report teachers of Grades 5 or Grade 8 were classified as math specialists if they enrolled in two or more university math courses or had achieved an education minor or major in mathematics. Grade 11 teacher respondents were classified as math specialists if they were an education math major or had completed 6 or more university math courses.

Figure 28: Pre-service Teacher Specialization by Grade

Math Pre-Service Specialization	Grade 5	Grade 8	Grade 11
Education Instructional Methodology Classes	25% (minor or major)	32% (minor or major)	57% (major only)
Math Content Classes (statistics, calculus ...etc.)	35% (2 or more classes)	32% (2 or more classes)	49% (6 or more classes)

Note: Number of Participating Teachers: Grade 5: 95, Grade 8: 29, and Grade 11: 46

Learning mathematics is developmental and complex. Student achievement results at a particular grade should not be viewed as student learning for that year, but rather their cumulative math learning experience across the previous grades. Mathematics student learning is a result of many teachers, not just one.

Results showed that participating students who had math teachers in 2001 with a major or a minor in mathematics education perform a little better than students that don't. These achievement differences were not statistically different.

Students who had teachers that have taken university math courses had varying achievement results. Teachers with two or more university math classes had a negative effect on achievement in Grade 5, a positive effect in Grade 8 and no statistically significant difference in Grade 11.

Teacher Attitudes and Practices

Teachers responded to a number of questions related to mathematics and learning. Figure 29 and 30 summarize some of this data.

Figure 29: Teacher Attitudes and Practices

Statement	Percentage of Teachers		
	Grade 5	Grade 8	Grade 11
At least twice a week, students meet in pairs or small groups to explore math concepts, communicate their understanding, and solve problems.	48%	50%	42%
Problem solving is often used to introduce and help engage students in learning new math concepts and content.	45%	27%	26%
Students are free to use manipulatives during testing situations.	21%	30%	22%
The most effective instructional method for most of my students is listening to the teacher.	62%	70%	81%
Fifteen or more marks or ratings are used to determine the final course mark for students.	34%	33%	39%
At least once a month, I meet with other teachers to plan math lessons, units, tests, or other math program matters.	25%	33%	35%
I like using a problem-solving approach to teach my students new math concepts.	49%	37%	30%
I like using manipulatives to teach math.	55%	40%	50%
I like to use journal writing in my mathematics classroom.	6%	3%	9%
The range of student abilities limit or restrict how I teach mathematics [quite a lot or to a great extent].	62%	50%	63%
I am satisfied with the extent to which most students are learning math in my classroom.	77%	97%	76%
The lack of in-service for teaching math limit or restrict how I teach Mathematics[quite a lot or to a great extent].	12%	10%	7%

Note: Number of Participating Teachers: Grade 5: 95, Grade 8: 29, and Grade 11: 46

Figure 29 shows:

- More Grade 5 than Grade 8 and 11 teachers like and use problems to introduce and help engage students in learning new math concepts and content.
- Approximately one-third of the Grade 5, 8 and 11 teachers use at least 15 marks or ratings to determine the final course mark for their students.
- About one-tenth of the Grade 5, 8 and 11 teachers indicate the lack of in-service limits or restricts how they teach mathematics. Over one-half of teachers indicated that the range of student abilities restrict and limit how they teach mathematics.

Classroom Instructional Time

Schools are asked to organize school timetables to provide suitable instructional time for learning mathematics. Providing this classroom time provides students with the opportunity to learn and maintain mathematics concepts and skills. In elementary schools (K-5) it is recommended that at least 210 minutes/week be spent learning mathematics. In the middle level (Grades 6-9), 200 minutes/week is the recommended amount of time. For the math courses offered in Grades 10-12, about 85 hours (before enrichment through optional topics) is expected.

According to teacher questionnaire data, the amount of classroom instructional time allocated by schools to teach mathematics varied across the province. Figure 30 outlines the percentage of classrooms that are provided the recommended amount of time.

Figure 30: Mathematics Instructional Time Provided in Schools, by Grade

	Grade 5 (210 min/wk)	***Grade 8 (200 min/wk)***	***Grade 11 (85 hrs/course)***
Percent of classrooms providing the recommended amount of instructional time in mathematics	*62%*	*87%*	*62%*

How teachers utilize mathematics classroom time is important. Teachers were asked to approximate the percentage of time spent for a number of different activities in their mathematics classroom. Figure 31 *(see page 34)* summarizes the average percentages outlined by teachers at each grade level.

Figure 31: Average Percentage of Time and the Number of Minutes Per Course Time Allocation for Different Mathematics Classroom Instructional Activities, by Grade

	Grade 5		Grade 8		Grade 11	
	Percent	210 minutes / week	Percent	200 minutes / week	Percent	85 hours / course
Non-instructional time (getting started, distributing materials, discipline, external disruptions, etc.)	7%	**15** min	5%	**10** min	6%	**5** hrs
Correcting with the class their homework or other assignments	14%	**29** min	14%	**28** min	16%	**14** hrs
Direct instruction (lecture, drill and practice, demonstration, etc.)	24%	**50** min	26%	**52** min	35%	**30** hrs
Individual or small-group activities (indirect instruction, experiential learning, project work, etc.)	17%	**36** min	18%	**36** min	6%	**5** hrs
Seatwork practice	31%	**65** min	30%	**60** min	32%	**27** hrs
Student evaluations	7%	**15** min	7%	**14** min	5%	**4** hrs

Note 1: Number of Participating Teachers: Grade 5: 77, Grade 8: 21, and Grade 11: 42.
Note 2: Percents may not sum to 100% because of rounding and number of minutes may not sum to 60 because of rounding.
Note 3: "Other instruction or activities" option was provided to teachers, but a very small percentage of teachers provided numbers for this category.

Figure 31 shows:

- About one-third of all mathematics class time is devoted to seatwork practice.
- Direct instruction (lecture, drill and practice, demonstration, etc.) increases in Grade 11 classrooms and indirect instruction (small-group activities, experiential learning, project work, etc.) decreases in Grade 11 classrooms

Conclusions and Next Steps

There were few differences between results of the 1997 and 2001 Provincial Mathematics Learning Assessments. When there were differences, the student performance results from the 2001 assessment were usually better. With a few exceptions, Grade 5, 8 and 11 students met panelists' expectations for adequate mathematics proficiencies. Performance results for mathematics communication skills and for higher or exemplary levels of performance did not meet panelists' expectations.

The Saskatchewan mathematics curriculum emphasizes the use of:

- interesting and relevant problem situations where students learn and apply new concepts in a variety of settings, including exploration using computers or cooperative learning structures; and,
- active learning of mathematics, using "hands-on" manipulatives and engaging in small-group settings to communicate and explore mathematics.

Improvement in students' understanding and use of mathematics to adequately prepare them for future opportunities and experiences in society will require a concerted effort from all. The following actions and processes must be continued to help carry on the improvement of mathematics student learning in Saskatchewan:

- the department providing leadership in supporting the actualization of the curriculum and addressing the needs of educators;
- school boards and administrators providing resources and processes for developing communities of professional learners,
- teachers using best practices and monitoring the effects of those practices to meet the needs of individual students and raising the mathematical proficiency of all students,
- students taking ownership of their learning and committing to engage in learning math; and,
- parents in partnering with schools and teachers actively supporting and encouraging learning with their children and looking for opportunities to apply and reinforce math at home.

Through the dedication and creativity of all responsible for developing children's mathematical skills and abilities, the students of our province will enjoy and improve their mathematics learning.